

Kaufman - Trading Systems & Methods - Chap18

Chap18

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18 Price Distribution Systems

Price movement is usually viewed as a chart on which each new time period is seen as a new bar or point recorded to the right of the previous prices. There are many applications that need to look at the way prices cluster, or distribute, rather than sequences of patterns. In options, it is important to evaluate the current market volatility to decide the chances of prices remaining in a specific range for a specific amount of time. To get that value, we use the standard deviation calculation first introduced in Chapter 2. The standard deviation gives the most basic measure of price distribution. From the value of 1 standard deviation we can estimate the chances of a price remaining within a range over time. The key values to remember are that 1 standard deviation defines 68% of the price movement (both up and down), 2 standard deviations contain 95%, and 3 standard deviations contain 99% of all price movement based on the sample of data used to calculate the standard deviation value.

USING THE STANDARD DEVIATION

The data used to determine the standard deviation is very important. Because it is a statistical measure, it is most accurate when a large amount of data is applied. For example, you might find that 1 standard deviation of the crude oil daily price move is only \$0.25 per barrel when measured over the past 10 years, but during the 6 months of the Gulf War the same measurement yielded \$.50, twice as large.

Most trading applications using the standard deviation tend to apply short data intervals to its calculation, such as 20 days. This short period is not likely to represent the same price distribution as a 10-year calculation; therefore, the probabilities given by the resulting standard deviation value must be interpreted differently. While it is less likely that the price will make a move of 3 standard deviations compared with 1 standard deviation, the probabilities can be misleading. Statistics tell us that there is only a 1% chance that prices will move a distance of 3 standard deviations higher or lower; however, that value is reliable only when measured over a long data period. If you selected 20 days of unusually low volatility, the chance of a 3-standard deviation move would be very high.

The frequency distribution is another very practical approach to measuring price distributions. This was also described in Chapter 2. It has the advantage of having a much clearer visual interpretation. While the standard deviation gives us what appears to be a highly mathematical probability, the large error factor that is caused by small amounts of data may make its usefulness about the same as the frequency distribution. In the following sections, both techniques will be used.

Standard Deviation Bands

Bollinger bands, discussed in Chapter 5 ("Trend Systems"), are a very popular application of price distributions. They do not detrend price, but calculate the standard deviation of prices over a period of 20 days and form a band of 2 standard deviations around the trendline. It is common for traders to vary both the period and the number of standard deviations

tions used to construct the band. Once calculated, Bollinger bands can be displayed on any price chart and used to generate buy and sell signals, much the same as any other channel breakout system. Using a smaller Bollinger band, for example, 1 standard deviation, will give many more signals than using one of 3 standard deviations. At the same time, a band of 3 standard deviations translates into risk that is 3 times greater than 1 standard deviation. Signals produced with a larger band tend to be more reliable, but have greater risk.

Bollinger bands also describe market volatility. A relatively narrow band translates into low volatility. By comparing a 21period Bollinger band with a 65period band, you can see the relative difference between shorterterm and longerterm market volatility in Figure 181. The thicker lines, representing the 65period calculation, cross the shorterterm band at points that show relative overbought and oversold situations. If this was a daily rather than a 15minute chart, the 21period band would give monthly volatility and the 65period band would be quarterly volatility, useful values for options traders.

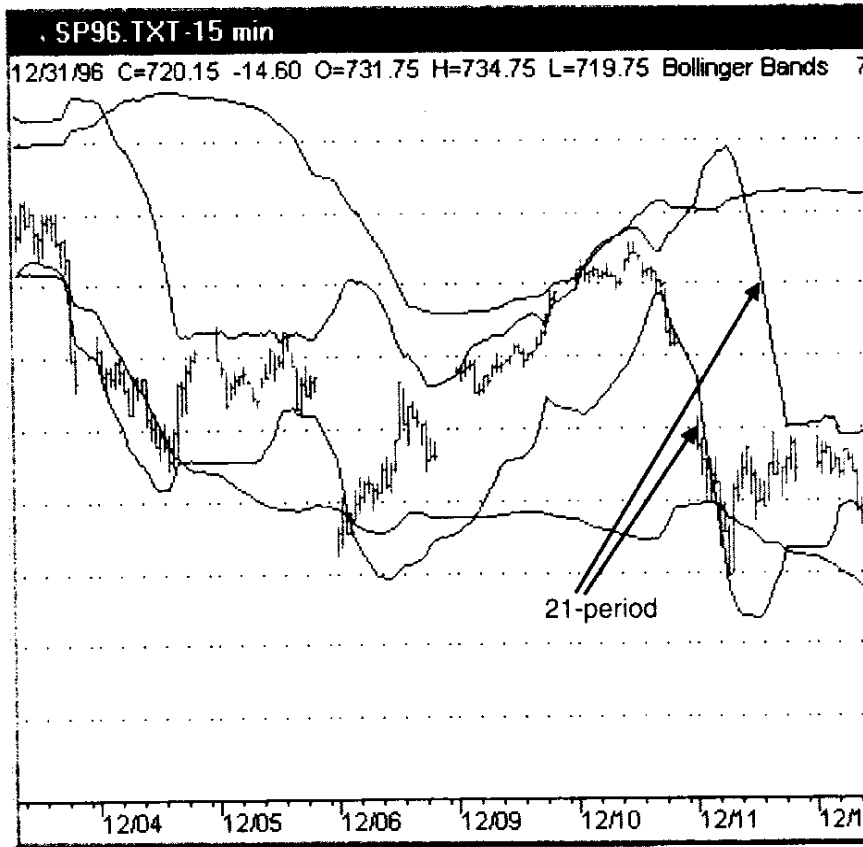
Problems in Using Moving Standard Deviations

Applying any technique to a rolling time interval of the most recent N bars is a common method of keeping in tune with current market conditions. in the case of a simple moving average, we should be very familiar with the lag that is introduced. For trends, when prices are moving steadily higher, the lag causes the trendline to be much lower.

There is a similar lag when using the most recent N bars to calculate a standard deviation, even when the data has been detrended. If we are measuring the volatility of the market, and prices rally quickly, the volatility rises. This will be seen in the larger value of 1 standard deviation measured over a fixed number of days, or bars. If we are looking for a confirmation of a buy signal based on an increase in volatility, we should get it.

However, the volatility represented by the standard deviation will not decline as fast as we expect because of the same lag. Once higher volatility has occurred on a single day. it

FIGURE 181 Comparison of 21 and 65period Bollinger bands.



Source: Chart created with *TradeStation®* by Omega Research, Inc.

451

will remain part of the standard deviation value until it passes completely out of the calculation window. That will prevent a new volatility event from being recognized soon after a short decline in volatility. It will also make it difficult, if not impossible, to get a timely exit signal on reduced volatility, because the lag keeps the volatility appearing high until at least part of this new, more active price movement begins to pass out of the end of the calculation window. This can also be seen in Figure 181, where the 65period bands expand quickly and narrow slowly.

USE OF PRICE DISTRIBUTIONS AND PATTERNS TO ANTICIPATE MOVES

Prices often form patterns that can be evaluated using probability methods, or simply viewed in much the same way as a frequency distribution, or histogram. Because the concepts are sound, but the statistical analysis is often difficult because of limited amounts of data or changing conditions, analysts have taken a much more empirical approach

toward studying price distributions. The following section will look at some innovative ways to look at price distributions and how they are interpreted into trading opportunities.

Analysis of Zones

Rather than using standard deviations to identify the chance of a price move above or below yesterday's closing level, Bruce Gould observed that historic prices could be divided into five zones, each 20% of the price range over the previous 3 years. Using this longterm approach, it is easy to see that selling in zone 1 (the lowest price levels) would have less opportunity for profit than selling in zone 2, just above it. Similarly, buying in zone 5, the highest band, would carry both the greatest risk and the least opportunity of profit. This is likely to remain the case unless prices move to much higher levels and all zones need readjusting.

J.T jackson' has used this concept to define five shortterm zones, based only on yesterday's prices, which can he associated with the strength or weakness of today's move. These daily zones, which are popular with floor traders, are calculated as:

Calculation	Zone	If Pri
High2 = Average + High1 – Low1	6	Stro
High1 = 2*Average – Low	5	Mod
Average = (High + Low + Close) / 3	4	Mild
Low1 = 2*Average – High	3	Mild
Low2 = Average + Low1 – High1	2	Mod
	1	Stro

where the High, Low, and Close are yesterday's prices. Note that there are five calculations but six zones needed to separate them. A test of how the S&P 500 falls into these relative rankings gives:

Zone	6	5	4
S&P frequency	20%	44%	83%

J.T. jackson, Detecting High Profit Day Trades In The Futures Markets (Windsor Books, 1994).
452

which shows the slightly upward bias expected of the overall equities market. These distributions may vary depending on the interval used in their calculation and whether there is a dominant trend during that period. A longer interval that includes bull, bear, and sideways markets would be safest; otherwise, there is the chance that the calculations will create a bull market profile, while some trading will occur during a bear market reaction. Although you can avoid trend bias by using longer intervals for the calculations, the zones tend to get very large.

The strategies for trading price zones focus on shortterm trends and holding periods. For example, you can sell when prices move into zone 4

(mildly up) with a stop in zone 5. If you consider zones 3, 4, and 5 as containing mostly market noise, then selling at the top of zone 4 and closing out that trade at about the average, or buying near the bottom of zone 3 and closing out at about the average, could capture the majority of price moves that have no direction.

Nonrandom Patterns

In evaluating the zone approach, the markets that offer the greatest potential for this strategy are those that show an abnormal distribution of prices within the six zones. For example, if the six zones were all equal in size, and the frequency of prices declined by onehalf as they moved from the center to the extremes, there would be a perfectly random distribution and no profit potential:

Zone of Equal Size	6	5	4
Normal distribution	7%	14%	28%

If the distribution is normal, but zones 3 and 4 are much wider than the outer zones, then the risk of selling at the top of zone 4 with a stop at the top of zone 5 and a profit target at the average (of zones 3 and 4) would result in an equal number of profits and losses, but the profits would be larger. If the zones are of equal size, the opportunities come when the distribution is clustered in the center:

Zone of Equal Size	6	5	4
Normal distribution	2%	8%	40%

In this case, selling at the top of zone 4 would result in many more profits than losses, although profits and losses would be of equal size.

Applying a Moving Average Distribution

To extend the time frame and include trend bias within the zone values, the same zones may be created by using the moving average values applied to the close, high, and low separately. For example, if three separate 2 1day moving averages are calculated on the high, low, and closing prices, the moving average values can be substituted for yesterday's high, low, and close to give new zones. In using this approach, a strong upward trend would cause all the zones to lag below today's prices, making current values strongly overbought. Zones created from the history of these averages will reflect the relative overbought and oversold price levels within trends. In a strong upward market, however, prices can remain in zone 6 while they are steadily moving higher in much the same way that an oscillator can remain over 80%.

453

Using moving average values is likely to change the way in which you trade these zones. For example, you might want to enter long positions only in zone 5 and look to exit in zone 6. You might find that, if prices close in zone 6 (very strong), they are likely to open in zone 4 (slightly higher).

Zones for Forecasting Range and Risk Control

Statistics have proved that, barring a superior forecasting method, the best estimate for tomorrow's price is today's price. That is, under most conditions, we cannot predict with any certainty that prices will go up or down tomorrow; therefore, the best estimate is to say that prices will be unchanged. However, if a trend system, such as a moving average, has been profitable, then its forecast for tomorrow is better than the mean. Market volatility; based on price changes, can be used with a directional forecast of tomorrow's price to create a set of zones used to control risk or project the probable trading range.'

Using a 10day moving average of the daily price changes,

$$A = @Avg(@AbsValue(close - close[1]), 10)$$

where close[1] represents the previous close. Taken as positive numbers, zones are created that center around the current price and expand according to the average price change (volatility) using the following calculations:

$$H2 = close[1] + 2 * A$$

$$H1 = close[1] + A$$

$$L1 = close[1] - A$$

$$L2 = close[1] - 2 * A$$

Five zones are then created by the areas above H2 and below L2, and the three ranges between H2, H 1, L1, and L2, all of which change in proportion to the nday volatility. These volatility levels, or bands, represent a very similar scenario to channel breakouts. The market often trades in a range defined by a normal or average level of volatility. When a new piece of information affects the price, it jumps to a new level, then trades with similar volatility (or slightly higher at first) at the new level. Most often, the first breakout of an existing trading range puts prices in a zone just above the old range, making the pattern appear to be divided into equal zones. This same philosophy is the reason that standard profit targets for a price breakout are equal to the previous trading range. Readers can find additional trading range projections in Chapter 15 ("Pattern Recognition").

DISTRIBUTION OF PRICES

in the search to understand how prices move, and what to expect, an analysis of price distributions can explain whether the market is trending, sideways, or unstable. Some of these patterns are clear and others need interpretation; in addition, the combination of patterns within patterns can become complex. The following is intended as a basic approach to interpreting price distributions, although each group of markets has special characteristics. Before engineering a systematic approach to trading, it is best to understand how prices are expected to distribute. This approach avoids surprises and the risk that goes with them.

LongTerm Price Distributions

A quick observation of price data for most tangible products, such as soybeans or gold, shows that we should expect a skewed longterm price

distribution, with prices clustering at lower

¹ Based on Tushar Chande and Stanley Kroll, *The New Technical Trader* (John Wiley & Sons, New York, 1994, p. 172).

454

levels and a long tail representing extreme high prices. In the case of gold, we should remember that prices peaked briefly at \$675 per ounce (New York cash price) in 1980, but have remained below \$400 most of the time before and after. If we consider \$375 as the approximate normal price of gold, then the rise to \$800 is a gain of \$425 per ounce. If \$375 were the average price, and distributions were symmetric, then gold would be able to decline an equal amount, which would put the low price at negative \$50 per ounce, which is not possible.

The process in which prices move up and down is not uniform. If the price of soybeans only gained a small percentage every year based on inflation, price forecasting would be very simple. Expectations, however, are based on carryover stocks (inventories), exports, weather, and government programs, all of which cause sharp price adjustments. These shifts up and down appear as steps on a price chart. Once a new step is reached, prices will fluctuate in a range with a new perceived base price. Within the period when the step is in transition, unexpected news will normally cause shortlived price peaks. Normally, prices trade at the lower end of the range.

Patterns of Market Groups

Those markets representing physical commodities, such as gold, soybeans, and coffee, have a cost of production that forms a practical lower bound to price movement. When there is ample supply, or low demand, prices decline to those cost levels, or slightly lower, volatility drops, and there is little price activity. This also applies to the interest rate market viewed in terms of yield. At low yields, volatility is proportionally low and prices move sideways with an occasional spike (downward for prices) in anticipation of change.

Currency markets are very different from physical commodities because they do not have a production cost, nor can you distinguish high from low. All currencies are quoted in terms of other currencies. What is high, relative to one country might be low compared with another. A stable political situation, low inflation, and a controlled balance of trade puts a currency at equilibrium provided that it is quoted in terms of another stable currency. With no expectation of surprises, the currency will trade in a narrow range, showing low volatility. Unexpected economic news moves the foreign exchange rate sharply up or down; normalization of the problem allows prices to return to a quiet equilibrium. This pattern can appear to be similar to a normal distribution.

Frequency Distributions

if we remember the qualities of a standard deviation when measuring price distribution, it assumes a symmetric pattern; therefore, a simpler frequency distribution can be used to provide a more convenient representation of price distribution. The frequency distribution makes no assumptions about the shape of the curve, but records the amount of time that prices remained within a specified range. For example, if we look at

the history of gold from 1976 through 1993 (see the bold line in Figure 182), prices have varied from \$100 per ounce in 1976 to \$675 per ounce in 1980. Because the first 3 years would lower the average, we will consider only the period from 1979 through 1993, which had a low of \$228. Dividing the price range into 20 parts, we get bars of \$23.60. Accumulating the history of monthly closing prices into the 20 slots from \$227.60 to \$251.20, \$251.21 to \$274.80, and so forth, we get a frequency distribution spanning the full range of gold prices, each bar indicating the number of months that the average monthly price fell in that bar. That distribution, seen in Figure 183, shows peak frequencies (gray bars) from \$392 to \$445, significantly below the midpoint price.

The total number of months from 1979 through 1993 is 228; therefore, we can find the approximate price that occurred at the 90% level by summing the frequency of the bars beginning at the highest price. Because 10% of 228 is 23, the bar that causes the total fire

455

FIGURE 182 Cash gold prices, CPI, and deflated gold prices .

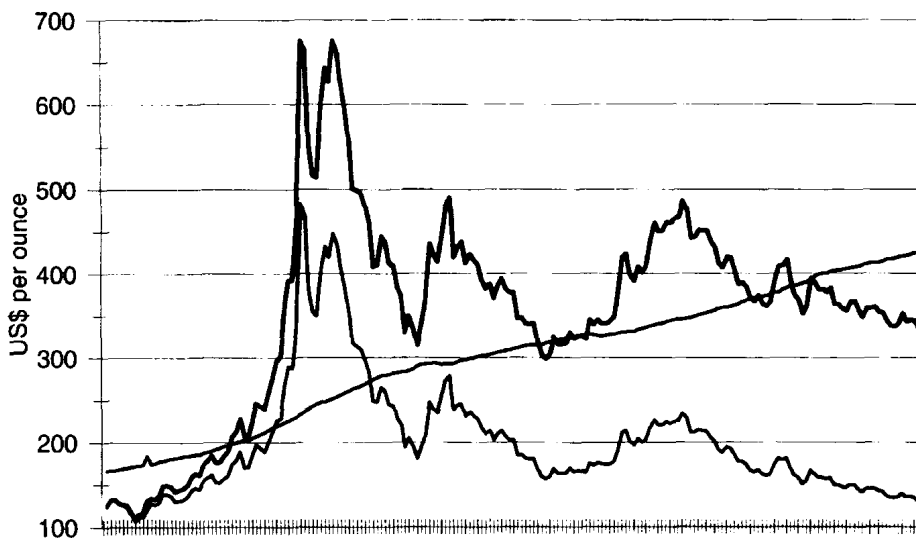
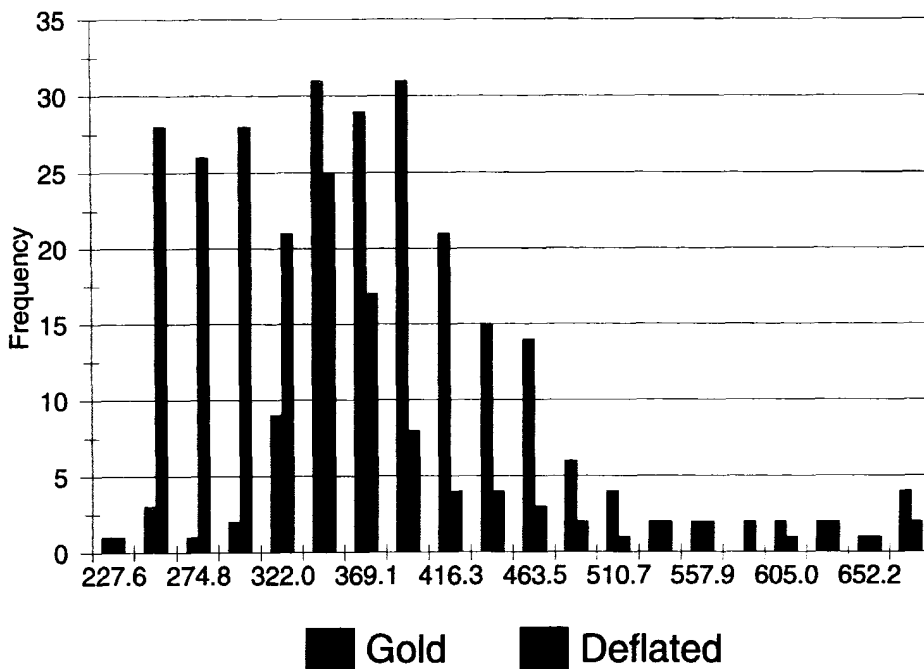


FIGURE 183 Frequency distribution of gold. Gray bars show the distribution of cash prices. The dark bars show the distribution of deflated cash prices. The deflated prices are skewed much further to the left



456

quency to exceed 23 will be the target price range for the 90% level. This works well for skewed distributions; the 90% level may be 3 bars from the top of distribution, while the 10% level may be the lowest bar of the distribution. For cash gold, the highest 10% of the prices span the highest 9 bars, while the lowest 10% are in the bottom 2 bars. This shows an extremely skewed distribution.

Adjusting for Inflation

One way of correcting for the apparent bias in the longterm charts is to adjust prices for inflation. That is, if we have a table of monthly Consumer Price Index values, all prices can be divided by the monthly percentage increase in the CPI. Therefore, if today's gold price is \$400 per ounce, and inflation last year was 5%, today's price of \$400 is divided by 1.05 to get \$381. If the actual price of gold was \$380 last year, it was very close to normal. In Figure 181 the CPI appears as a steady increase which, when used to adjust the cash gold prices, shows that 1993 prices had returned to 1979 levels on an inflationadjusted basis. The frequency distribution of the adjusted prices, seen in Figure 183, shows a much broader frequency at lower levels and a smaller, longer tail at higher prices. These patterns are fundamental to understanding and using price distributions.

Structural Changes

Despite the need to correct for inflation, structural changes will affect the smooth pattern of the frequency distribution. For gold, cash

prices below \$100 per ounce are part of history that we can choose to ignore for now. By creating a new frequency distribution that reflects prices beginning in 1979, some of the price inconsistencies can be eliminated. For other markets this may not be as easy, because the structural changes may occur within the normal range of historic prices.

Medians and Means

Although the inflationadjusted longterm distributions show that prices spend much more time at lower levels, there is a tendency to consider the average price of a market as the midpoint between the highest and lowest prices. Using the gold example, the midpoint for 1979 to 1993 was \$451. The average of all monthly prices will give a reasonable approximation of a normal price; however, the best measure is the median, or middle, value when all monthly prices are sorted from high to low. The median value for gold over the same period was \$381. If we look back at Chapter 2 ("Basic Concepts"), we find that skewness is measured as the difference between the mean and the median, as a percentage of the standard deviation. In this case, the difference of \$70 is a very large value, indicating a distribution with a peak far to the left of center. For price distributions, the median is a much more useful value than the average, although not as convenient to calculate. The median naturally adjusts for the skewness in the price patterns.

ShortTerm Distributions

Unlike the predictable patterns of the longterm price distributions, the distribution patterns of short intervals can vary widely and have been interpreted in many ways. Shortterm distributions are not anchored to a base level because the entire period of analysis may be at prices that are significantly above intrinsic value or production costs, and away from equilibrium. Keeping in mind the normal shape of price distribution for each market group, a different configuration can be a strong indication of expected price movement.

Three distribution patterns are shown in Figure 184 (bd), along with the larger, longterm distribution (a). The first shortterm distribution (see Figure 184b) shows a pattern with a long tail toward the higher prices and a large accumulation near lower price levels in a manner very similar to a longterm chart, but with the extended tail much shorter and

457

a little more extension on the bottom. This is most likely to occur at low price levels, where most activity is near the bottom with occasional short excursions up. This can be a small segment of a normal pattern or a temporarily higher level that is stable. Figure 184c is a bellshaped, symmetric curve that could indicate a congestion area or shortterm equilibrium. When prices trade equally within a range they do not exhibit any likelihood of favoring an immediate breakout either up or down.

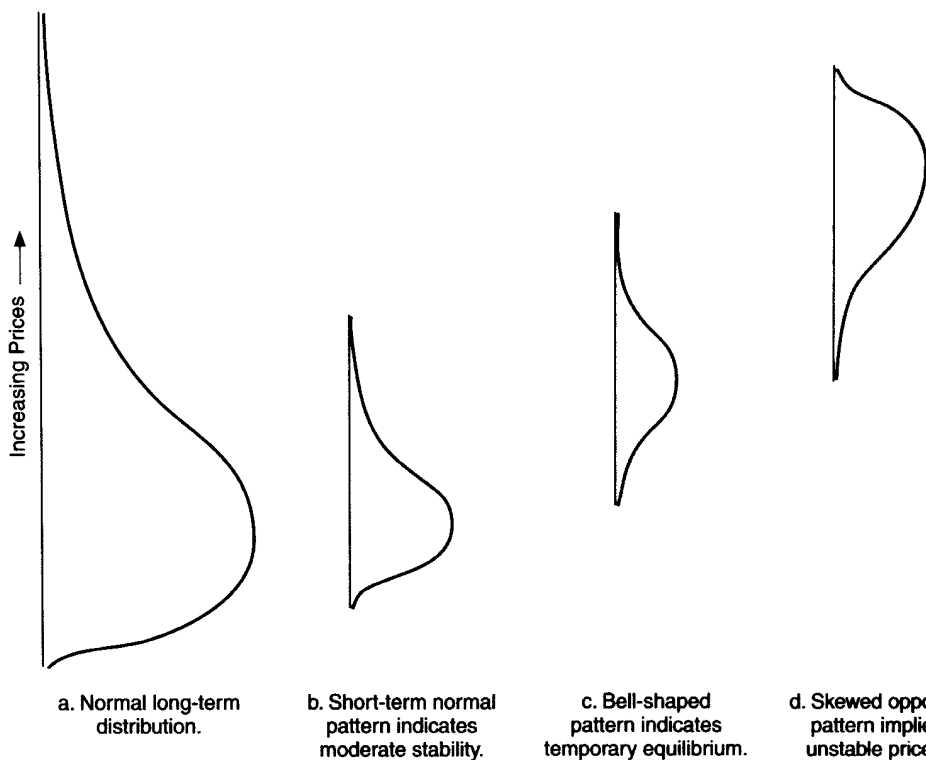
The fourth distribution (see Figure 184d) is most interesting, because it is skewed in a pattern opposite to (b) and to the normal longterm distribution. For this pattern to have developed required a relatively short, quick move to a higher price level, then a congestion area formed at the higher level. You can be certain from this pattern that prices are higher than

normal. By the very nature of the pattern, we can say that this price level is unstable, and that prices are more likely to go down than up. This last conclusion does not require statistics, because prices at high levels must not necessarily continue to rise, but they must eventually fall.

Identifying Potential Price Moves

From the patterns just described, the combination of a distribution of a long tail toward higher prices, but at a relatively low level, offers no promise of a potential price move.

FIGURE 184 Three shortterm distribution patterns. (a) A traditional, longterm distribution. (b) A shortterm distribution indicating stable prices at a temporarily higher level, or a permanent change. (c) A bellshaped curve representing congestion but not indicating future direction; the market is in suspension or temporary equilibrium. (d) The tail points to lower prices with most activity at higher prices; the market is unstable and has substantial downside potential.



458

Prices that are not near the base level are always likely to move, and the farther they get from the base level, the more volatile they become. Three formations show that there is a greater chance for a move.

1. A broad, often erratic formation indicates volatile, current movement. Prices have not remained at one level and have not yet established a welldefined pattern or trading range.

2. A skewed distribution (with the tail toward higher prices), the mode well above the base level, and where the current price is at the extreme away from the tail (lower prices) indicates a likely move down.
3. A skewed distribution (with the tail toward lower prices), the mode well above the base level, and where the current price is in the tail (lower prices) indicates a likely move down.

Any time prices form a distribution that is not the same as a longterm distribution, and not at low levels, there is potential for movement and volatility.

STEIDLMAIER'S MARKET PROFILE

Market Profile, the effort of J. Peter Steidlmayer, appears to be a frequency distribution of intraday price movement but has used time, rather than volume, as its key element. Steidlmayer formalized this technique in 1985 while at the Chicago Board of Trade. The Board considered this such a unique insight that they copyrighted his work as Market Profile and Liquidity Data Bank. It was intended to provide detailed information to traders about how trading was facilitated. Market Profile offers much more than a count of how many times a price traded at one level. With proper studying, traders are able to separate participants by time frame and even identify their trading patterns. Figure 185 shows this technique as it originally appeared, with letters denoting sequential 30minute time periods, and an analysis of who participated in the trade at each price.' Called a customer trade indicator (CTI), these categories are CTI 1, the local floor traders; CTI 2, the commercial clearing members; CTI 3, clearing members who fill for other members and nonclearing commercial traders; and CTI 4, clearing members who fill orders for the public or other customers not included in the previous groups (outside paper). This information, on whose behalf the trade was executed, is only available after the close of trading.

To understand what is described in Market Profile and the Liquidity Data Bank, you must know that the locals and commercial clearing members, CTI 1 and CTI 2, account for the largest part of volume (over 65%), and both have trading styles that are very different from the offfloor speculators who form groups 3 and 4. The locals take smaller positions, often counter to the current price moves and hold that trade for a period spanning seconds to a few hours. Most locals even up at the end of the day, which avoids the need to finance their positions. The commercials might be a bank that is hedging an existing currency exposure or arbitraging a gap between two or more shortterm rates in the cash market. These positions may move the market but can be insensitive to current price direction and flow into the market at arbitrary times.

Outside paper, a term that refers to customer accounts, range from individual speculators to major fund managers. Because they trade from off the floor, their style of trading favors holding positions for more than 1 day, and a large majority will be trend followers. The style of CTI 3 is similar to CTI 4; that is, both tend to be directional, and the two can be combined for the purposes of evaluation. Although they account for a smaller portion of the volume, they are more influential in the shortterm direction. Fig

FIGURE 18-5 Original Market Profile for T-bonds.

Market Profile															
Analysis of a Trading Day															
Price	Volume	% Volume by Type of Trader				Participation				% Count		% Volume		Ratio (1 + 2) / (3 + 4)	
		Cti 1	Cti 2	Cti 3	Cti 4	Cnt	Cti 1 + 2	Cti 3 + 4	% 1 + 2	% 3 + 4	% 1 + 2	% 3 + 4			
9609	736	54.6	8.8	0.0	36.5	LM	2	63.4	36.5	1.3	0.7	46.7	26.9	1.74	Buy 3 + 4
9608	8009	56.2	14.3	7.3	22.3	LM	2	70.5	29.6	1.4	0.6	5646	2371	2.38	
9607	7410	56.9	16.0	8.1	19.0	KLM	3	72.9	27.1	2.2	0.8	5402	2008	2.69	
9606	18142	62.1	13.0	3.5	21.4	KL	2	75.1	24.9	1.5	0.5	13625	4517	3.02	Sell 1 + 2
9605	31686	62.5	11.7	4.0	21.9	KL	2	74.2	25.9	1.5	0.5	23511	8207	2.86	
9604	13018	58.5	17.4	2.0	21.8	KL	2	75.9	23.8	1.5	0.5	9881	3098	3.19	
9603	14290	60.7	11.7	4.5	23.1	KL	2	72.4	27.6	1.4	0.6	10346	3944	2.62	
9602	5302	52.8	11.8	1.6	33.8	K	1	64.6	35.4	0.6	0.4	3425	1877	1.82	Buy 3 + 4
9601	3616	69.9	8.7	6.2	15.3	JK	2	78.6	21.5	1.6	0.4	2842	777	3.66	Sell 1 + 2
9600	4884	50.5	8.4	1.9	39.1	JK	2	58.9	41	1.2	0.8	2877	2002	1.44	Buy 3 + 4
9531	11828	60.4	12.5	1.2	25.8	J	1	72.9	27	0.7	0.3	8623	3194	2.70	
9530	13464	57.1	16.7	2.5	23.8	J	1	73.8	26.3	0.7	0.3	9936	3541	2.81	
9529	15878	59.7	12.7	3.5	24.1	J	1	72.4	27.6	0.7	0.3	11496	4382	2.62	
9528	4802	57.9	18.1	2.6	21.5	J	1	76	24.1	0.8	0.2	3650	1157	3.15	Buy 1 + 2
9527	4292	50.4	12.1	1.6	35.9	GJJ	3	62.5	37.5	1.9	1.1	2683	1610	1.67	Buy 3 + 4

460

ure 185 combines CTI 1 with CTI 2 and CTI 3 with CTI 4 to simplify the patterns attributed to each group. During the period shown in the figure, the combined categories 3 and 4 cause the market to move when their participation was greater than 30%. Observation shows that these trading

points occur as prices move out of a previous area of sustained trading.

Steidlmayer was said to have first developed this information for his own trading. He taught a course on how to apply his evaluation technique, and there were a number of books written on the subject by himself and others.' He spent considerable time studying and classifying formations and separating days into three primary categories: normal, trending, and nontrending. A normal day forms a standard bellshaped curve with the widest point, positioned near the center, called the value area. On a trending day, the value area is not as wide and appears closer to one end of the distribution. A nontrending day has neither of the two recognizable patterns.

There is an important philosophic basis for Steidlmayer's work. It is a very credible attempt to explain how the market functions. He says, "The market probes high prices to attract sellers and low prices to attract buyers." This creates a value area. By observing the patterns of intraday price distribution, you can know whether there are countertrend opportunities, when prices reach the extremes of perceived value on a normal day, or trend positions in the direction of current price movement.

Construction of Market Profile

The Market Profile is created in a manner very similar to a pointandfigure chart. You can list every price on the left scale or create boxes that represent a price range. This latter technique will make the distribution look more uniform by clustering the price activity in exactly the same way as a frequency distribution.

The most common way of plotting intraday data is to begin by placing the letter A in the boxes alongside the price at which the market traded. if we use halfhour intervals, called time/price opportunities (TPOs), then all prices that were traded during the first half hour are marked with the letter A. The letter B is used for the second halfhour period, the letter C for the third period, and so on. At the end of the day we have a chart that looks similar to Figure 185.

Market Profile is also intended to be used over many days, identifying longterm patterns as congestion areas or trending markets. To the extent that it accomplishes this distinction it can be very valuable. The ability to determine whether the market is directional or not is the greatest problem of the trader. In Figure 186, the Market Profile is constructed by using numbers instead of letters to represent the range of prices traded over each day. The entire chart covers a period of 9 days. Other than the substitution of days for halfhour periods, the chart is created in the same way.

Time/Price Opportunities

Time/Price Opportunities (TPOs) are the 30minute blocks assigned letters on the Market Profile diagram. It is worth noting that the largest occurrence of TPOs at a single price does

Three books on Market Profile appeared in 1989: J. Peter Steidlmayer, *Steidlmayer on Markets* (John Wiley & Sons); Kevin Koy, *Markets 101* (MLS Publishing, 401 S. LaSalle St., Chicago, IL 60605); and Donald Jones, *Applications of the Market Profile* (CISCO, 32 S. LaSalle St., Chicago, IL 60604). The most complete material, however, comes from the original course taught by Steidlmayer, called the Market Logic School Readers may also want to study the original publication, *CBOT Market Profile* (1984, available from the Chicago Board of Trade); also J. Peter Steidlmayer and Shera Buyer, *Taking*

FIGURE 186 Daily Market Profile.

Value Area Using Daily Data

Price	Day Traded	
10228	1	
10224	12	
10220	120	
10216	120	
10212	120	
10208	245790	
10204	2456790	36 day counts
10200	245679	
10228	2345679	
10224	2345679	
10220	23589	
10216	589	
10212	58	

Source: Jones, Figure 2, "Locating value with auction market data," *Technical Analysis* (July 1989).

not necessarily correspond to the price at which the highest volume occurred, as seen by referring back to Figure 185. This distinction is at the root of Market Profile, because it emphasizes the amount of time that traders accepted a price, rather than the volume traded at that price, which could have occurred during a single period. In the bond example given in Figure 185, the greatest volume was transacted at 9520, although the center of the value area, where there is the largest record of TPOs, is at 9523, three points higher. Clearly, the Market Profile analysis is seeking out a different way of observing the actions of traders. In the formation of a value area, if the market moves between two prices, such as 9520 and 9523, because those values bracket the current trading range, each traverse will cause the prices in between to be marked with the same TPO letter, regardless of whether any volume occurred at those prices.

TPOs allow us to judge the potential direction for a move out of the current value area. This can tell a trader to buy strength or sell weakness. The market is said to favor the direction indicated by the upper or lower part of the value area that has the highest TPO count. When performing the TPO count, you must have a welldefined value area and limit the count to within that range. Using Figure 185, with the mode at 9523, count the TPOs prior to the interval that begins j. There were 16 TPOs above 9523 and 21 below (not including 8\$ and 3Z). During time intervalJ, the balance

shifted to the upside when it touched 9529, at which point there was a large increase in volume. This could be attributed to CTI 1 and CTI 2 exiting shorts and, to a lesser degree, going long. The locals were finally joined by groups 3 and 4, taking a long position at 9600. An imbalance in the TPO count expresses a willingness for the market to favor the direction given by the largest count, but applies to a normally distributed value area only.

Typical Patterns

It is generally accepted that the market spends the greatest time in a sideways, or congestion area, and a relatively small amount of time trending. The sideways period may be defined as an extended time/price relationship and the trending period as a brief time/price relationship. The extended period creates a value area where traders are will

462

ing to buy and sell, and this activity is reflected in higher volume. According to Market profile, 5

Value = price x time = volume

In this analysis, called auction theory, the value area is the place that the market is willing to trade, and is seen in the time value. The value area represents about 70% of the market volume. The center of this time value area is the price at which there are the most TPOs. Because market activity spends at least 80% of the time in this value area, prices tend to rotate about the center. Rotation is the term given to price action that moves back and forth above and below this central value, building the pattern of normal distribution similar to a bellshaped curve.

What Are the Buyers and Sellers Doing?

The interpretation of the Market Profile is based on the concept that, under normal market conditions, prices rise to attract sellers and fall to attract buyers. There is a very active area of trading at a point called equilibrium where commercial buyers and sellers exchange freely, because they consider the price at value (Figure 187, panel a). If there are more buyers than sellers, the price rises to attract additional sellers who feel as though they are getting a price that is above value. However, as prices continue to rise there are fewer buyers, because they perceive the market as overpriced. In Figure 187, Day 1 (panel b) shows a buyer's curve and a seller's curve drawn on the frequency distribution of a normal trading day.'

In this way the market is said to facilitate trade. When there are not enough buyers, the price falls; when the sellers are scarce, prices rise. Constructing the buyer's and seller's curves for a sequence of days can help understand the dynamics of trading in terms of both price expectations and volume. For convenience, the curves will be shown as straight lines, similar to supply and demand lines, in the following examples.

On Day 2 in Figure 187 (panel c), the buyers disappear faster than the sellers; therefore, the buyer's curve is more horizontal and the seller's curve more vertical. On Day 2 (panel c), the sellers have held their position and the buyers are wining to move higher, retreating from their previous objective. This results in higher volume. Had the buyers moved lower and the sellers remained steady, the volume would be expected to decline. If on Day 2 (panel d) the volume increased while prices traded in the same range

and at about the same peak price level (value level), the buyer's and seller's curves would have become more horizontal, indicating that both sides of the trade were holding firmly at the current level.

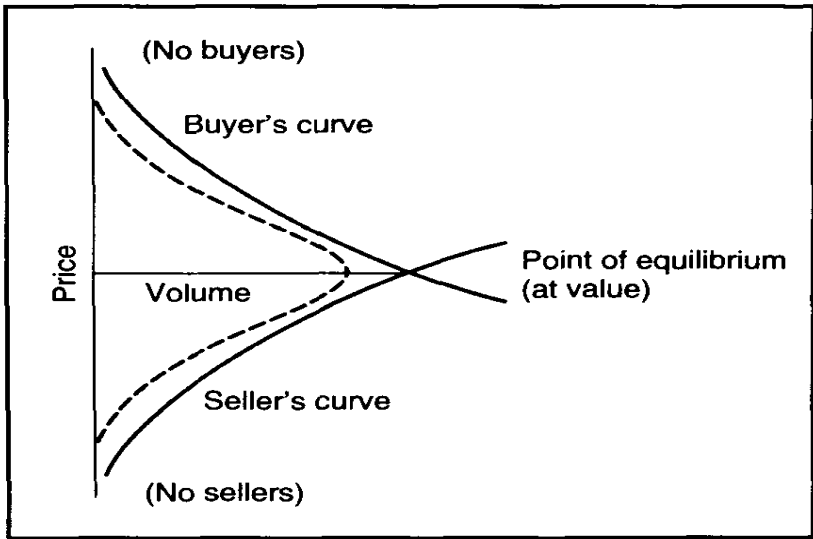
Quantifying the Value Area

The idea of a value area that is shaped as a bell curve, or an extended formation to represent a trending day, seems clear., unfortunately, patterns are rarely as clear as these examples. To help this process, Jones has applied overlays to these patterns, using a standard deviation to measure them. In Chapter 2, we explained that, for a normal distribution, the value of 1 standard deviation represents a clustering of 68% of all values around the mean; therefore, 34% are on either side. Similarly, 2 standard deviations contain 95% of all activity, 42.5% on either side of center. In his analysis, Jones has defined a value area as one contained within 2 standard deviations of the center using the TPO count to isolate the range. For example, if the entire chart contains 100 filled boxes, the price range is from 6615 to 6655, the center is right at 6635 and contains 10 filled boxes, then 2 standard deviations contain $90 \times .425 = 38$ boxes on each side of the center. This defines the value area.

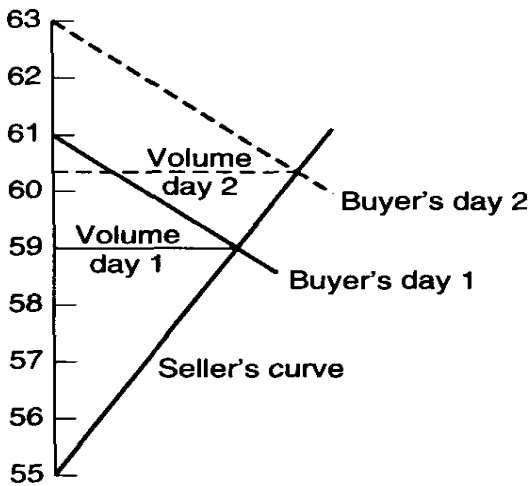
⁵ Donald L. Jones, "Locating value with auction market data," *Technical Analysis of Stocks & Commodities* (July 1989).

⁶ The following discussion is based on Robert Pisani, "How market structure helps you analyze price behavior," *Futures* (October 1987).

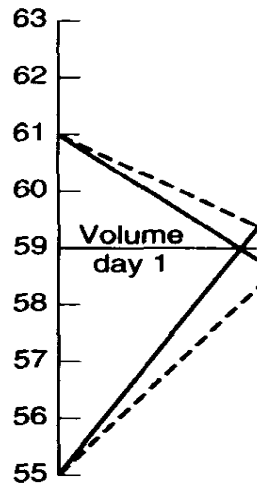
FIGURE 187 Buyer's and seller's curves for a sequence of days.



(a) Theoretical buyer's and seller's curve



(c) Day 2
Volume shifts,
sellers remain firm, buyers retreat



(c)
Both buyers and
volume increase

Trending Markets

Trends spread volume out over price and are relatively easy to see. in the previous discussions, there is an early warning of a trend when prices move out of the value area or when there is a larger number of TPOs on one side of the center of the value area. Trends develop when the market attempts to probe a new price level causing the current price to diverge

from the value area. The participants may reject this divergence and the price will return to the previous area causing a broadening formation, or they may accept the new price as fair value and generate a new value area by attracting volume (see Figure 188). The initial move that fails to find a new value area is called price trend; it usually begins and ends within a single time period (one TPO, which could be a half hour or a day). A price move that attracts volume over a longer time period is called a value trend. Daily charts, or a sequence of in~ 30minute charts, are easier to use than a single 30minute chart when looking for a trend.

When comparing the Market Profile of successive days, it is helpful to watch the activity of the recent day compared with the value area of the previous day. When trading within

464

FIGURE 188 Market Profile for a trending market.

Beginning of a Trend

<i>Price</i>	<i>Day Traded</i>	
10228	1	
10224	12	
10220	120A	
10216	120A	
10212	120AB	
10208	245790AB	
10204	2456790ABC	
10200	245679ABC	
10228	2345679ABC	
10224	2345679C	
10220	23589C	
10216	589C	
10212	58C	
10208	CD	Breakout at 10208
10204	CD	
10200	DEH	
10128	DEGH	Consolidation or new
10124	DEGHJ	value area being formed
10120	DEGIJ	around center of 10124
10116	DEFIJ	
10112	FI	
10108	F	

the previous value area, both buyers and sellers are considered equal. A move above the value area is considered as motivated by the buyer and reactive by the seller, and trading below the prior value is initiated by the seller and reactive by the buyer.

Trends do not move in a fast, straight line to their correct new level; instead, they move in steps, pausing to test whether a new value area can be formed that facilitates price. The trend continues in this way until prices retrace to the previous consolidation area, where the TPO volume is

expanded and the area is broadened, resulting in a value area.

Some Points to Remember about Market Profile

One great advantage of using the TPO count, rather than traditional volume, is that the Market Profile can be created at any time on any market. All the necessary information is available. The method is very different from traditional trending approaches and offers insight into the current status of price action, whether it is in a consolidation phase or trending. Although the evaluation of Market Profile has been very interpretive, there have been important steps toward defining value areas and trends in a more objective way. Using the overlay method proposed by Jones, a very simple trend filter could be constructed so that new trend trades, based on traditional moving averages, are not set until prices move out of the value area. During the past few years, there seems to be less interest in this technique; however, its underlying simplicity and clear distinction between other methods of analysis should keep its standing as a tool worth studying.